

Prosumers and Webmapping-Applications in Web 2.0

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Abstract. An increasing amount of Internet users create and publish maps in the World Wide Web. Easily manageable Webmapping applications make it possible to create user generated maps directly in the Web browser. Map users also become more and more map producers (prosumers). In my case study the users of the Webmapping application StepMap were analysed by an online survey. Furthermore the application was tested regarding the usability and user experience by students. Conclusions will be drawn with the aim of improving the support for the prosumers in their map creation. A concept for a Webmapping application will be proposed where the prosumers will be guided through a dialogue-oriented step-by-step process so that only relevant features and design opportunities will be offered to them.

Keywords: prosumers, Webmapping 2.0, user-generated maps, usability

1. Introduction

Internet users collect and publish an increasing amount of spatio-temporal data, with which they create and distribute their own maps in the so called Web 2.0. Without expert knowledge users can create their own maps quite easily with the aid of application programming interfaces (APIs) or with ready-to-use Webmapping applications in a Web browser. According to the term Web 2.0 this kind of map making can be called **Webmapping 2.0** (Haklay et al. 2008, Gartner 2009, Hoffmann 2011). Maps can be created by users in a personalised or collaborative way. Nowadays map users also turn into map producers and can be called **prosumers** (producers + consumers). They are producing their own maps regarding their interests and needs and use them in their everyday life. Furthermore these maps can be published online and therefore be used by all of the other Internet users.

This development has certain implications for the discipline of cartography since new challenges and changes in cartographic practice and theory occur.

The increasing importance of prosumers and user generated maps necessitate a detailed analysis of the user requirements and the tools they use to create maps in the Web. Developments for applications in the Web are often technology-driven without considering the actual users. The huge amount of prosumers who create and share a lot of data and maps on a voluntary basis in their free time holds a lot of potential capacity (e.g. for crisis mapping). The aim should be to improve the support for the prosumers so that they can create more accurate, readable and useful maps. Therefore more research has to be done about the prosumers and the Webmapping tools. This paper focuses on ready-to-use Webmapping applications (like Google My Maps, Scribble Maps, GeoCommons, MapBox) since they are quite easy to use by every Internet user and no programming skills or additional software are required. After giving an overview about the prosumer and their role in the process of cartographic communication a case study will be presented in which the prosumers of a Webmapping application have been analysed. Additionally a usability test of the same application was carried out. Requirements and hints as well as a concept for the design of Webmapping applications for prosumers will be given based on the results of the user survey and the usability test.

2. Cartographic Communication in Web 2.0

The “new” group of prosumers gain more and more influence in the cartographic communication and information processing. The classical cartographic communication model from Kolacny (1969), which is simple, clear and adjustable, still provides a good basis for a graphical model of the theory of cartography (Freitag 2001). In this model the prosumers occur as a new group which affects the whole process of cartographic communication starting from data acquisition, going on to map production and map use (see *Figure 1*). Within the Web 2.0 cartographers are providing their knowledge only in form of components (e.g. tools and base maps). Prosumers can choose from these elements, combine them in their own manner with Webmapping-APIs or Webmapping applications and design their own maps driven by their interests and needs.

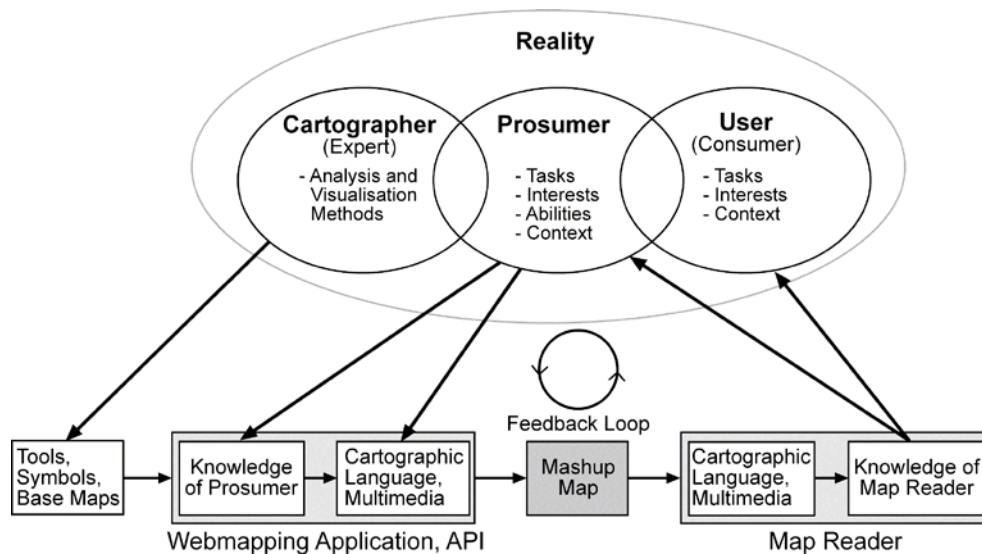


Figure 1. Cartographic Communication in Web 2.0 (based on Kolacny 1969).

The thus created maps are often called mashup maps because they combine data from different sources within one map (Hoffmann 2011). The prosumers are presenting the information they want to deliver on a base map using map signs and symbols (cartographic language). They also use multimedia elements like pictures or videos and link them to the map. If other prosumers read this map it can induce them to make changes regarding the cartographical presentation or the data (feedback loop). This adapted cartographic communication model for Web 2.0 makes the central and important role of the prosumers clear and therefore the thus occurred changes in the cartographic information processing.

3. Case Study: Prosumers of StepMap

In order to get a better understanding of the prosumers as well as their requirements and wishes, a case study was undertaken about the users of the Webmapping application StepMap (www.stepmap.de). This application is mainly known in German-speaking countries and is easy to use and one of the few German-speaking Webmapping-applications. Without further knowledge and additional software Internet users can create their own maps in a step-by-step process on the basis of different base maps simply

using their Web browser. The registered users of this application were invited by the StepMap-newsletter to take part in an online survey.

The main issues of this survey were the following: Who in terms of age, sex, education, etc. are the prosumers? Why do they create maps? And for which purposes do they use their own maps? The study was also aiming at getting to know more about the requirements and wishes of the prosumers regarding the application. So the main aspects for this survey were demographical characteristics, user behaviour, motivations, map themes and map purposes as well as user requirements.

79 valid responses could be used for the analysis. The survey proved that male users clearly dominate (male 71 %, female 28 %, missing 1 %), although less than in many VGI projects like OpenStreetMap where the male users exceed 90 % (Budhathoki 2010, Stark 2010). 48 % of the prosumers own a university degree. Regarding the age *Figure 2* shows that not only young people who grew up with the Internet use this application. 50 % of the questioned users range between 40 and 59 years of age. The user behaviour shows that a considerable amount of users (28 %) use StepMap mainly for job-related reasons. In contrast to that 58 % create maps mainly for private use. And 14 % use StepMap for both, private and occupational matters. This can be traced back to quite a lot of teachers and tour operators using this application for job-related reasons. Most of the prosumers use StepMap rather sporadic (37 % once per month, 40 % less than monthly). The majority creates only a few maps. 83 % created only 1 to 10 maps in total (see *Figure 3*). This proves that many of the prosumers use StepMap only occasionally. Therefore it is important that the application is easy and intuitively to use and doesn't need special skills or training.

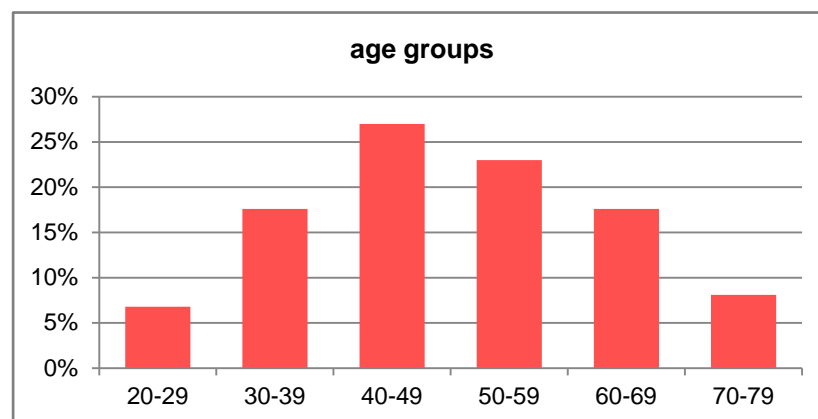


Figure 2. Age groups of StepMap users.

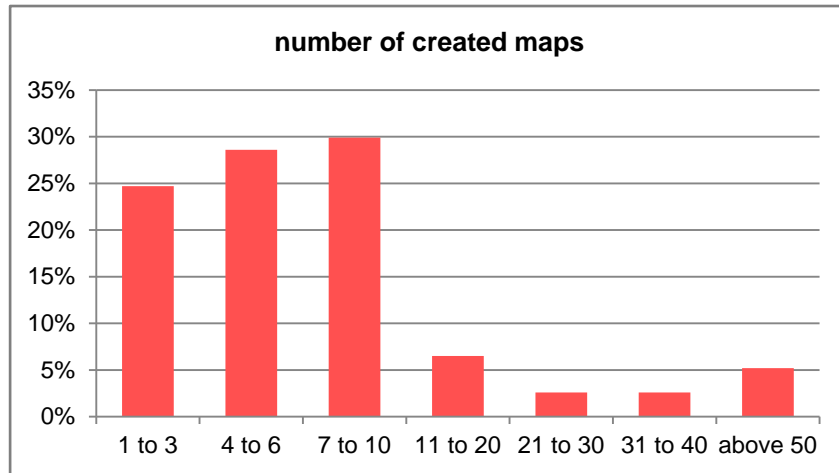


Figure 3. Number of created maps by the prosumers of StepMap.

But why are the prosumers spending their time with creating maps at all? Motivational factors can be divided into intrinsic and extrinsic motivations. In case of intrinsic motivations inner incentives like fun or challenges lead to an action. Extrinsic motivations occur in case of external incentives like rewards (e.g. salary) or the avoidance of a punishment. Based on different VGI studies (Budhathoki 2010, Stark 2010, Coleman et al. 2009) relevant motivational factors were identified and asked for in the online questionnaire as to get some insights about the motivations of the StepMap users. The survey shows that intrinsic motivations like creating individual maps, fun, map fascination and delivering information to friends dominate. This confirms the findings of Budhathoki 2010 and Stark 2010. But most of the questioned prosumers also mention the cost-free use as a motivation and even around a quarter say that they use StepMap for job-related reasons.

The themes represented in the maps are mainly related to the subjects travelling, country or regional overview maps and private POIs. This correlates with the map purposes. 42 % create maps for trip-related reasons like planning a journey or documenting a past trip. Around 30 % use StepMap to present a special topic on a map. About 28 % use the maps as graphical eye-catchers on their websites or blogs and around 25 % create maps for educational purposes e.g. schools or trainings.

Open-ended questions were used to ask about what users like about StepMap and which kind of improvements and other features they suggest. The

answers were evaluated via content analysis and are presented in *Table 1*. Regarding the improvements and further features around 35 % of the questioned prosumers would like to add special features which contain a legend tool, overview maps, special map sizes, animations and symbol editing tools. These wishes are quite different from each other and depend on the certain user requirements and their interests and needs. On the other hand some of the suggested features like overview maps were already realised in the meantime and are included in the application. About 15 % would like to have more graphical design possibilities like hatching, colouring of regions or more labelling options. Furthermore the improvement of existing features was mentioned by some respondents regarding the zooming or the positioning of cities as well as more details within the base maps like different POIs, more detailed topography and different relief presentations.

Aggregated answers of the prosumers	Percentage of answers
Intuitive use and map creation	39,2 %
Free use	19,0 %
No answer (missing)	19,0 %
Individual maps regarding one's own needs	9,0 %
Fast creation of maps	9,0 %
Good service and staff	9,0 %
Many design opportunities	9,0 %

Table 1. Results of the open question “What do you especially like in StepMap?”.

4. Usability Testing

In addition to the prosumer survey another research design was used for analysing Webmapping applications. The aim should be to create useful and user-friendly applications for everyone. Therefore StepMap was tested by students of the University of Osnabrück regarding its usability and user experience. The test was held twice, at first with 12 students of Geoinformatics and the second time with 18 students (7 Geography students and 11 Geoinformatics students). The students got the task to get to know the application on their own and to create a map with the subject “My place of study in Niedersachsen”.

The usability test was based on the standardised questionnaire ISONORM 9241/110-S (Prümper 2007). The usability measures the ease-of-use and usefulness of a product. By using a product the focus lies here on achieving certain goals with effectiveness, efficiency, and satisfaction in a specified

context. In the case of StepMap the aim was not to go through a complete usability test but to get to know some important usability aspects regarding the users who use this application quite shortly for the very first time. These aspects were based on some of the general ergonomic dialogue principles of the ISO 9241-10 for example suitability regarding a set task (e.g. completeness, fitting the task) and ability for self-description (e.g. explanations according to specific situations) (Sarodnick & Brau 2011). Therefore the questionnaire ISONORM 9241/110-S was shortened and adapted for these two tests. The students had to estimate the different aspects on a seven-point rating scale from very negative to very positive.

In general the usability was predominantly evaluated as good and was rated quite similar in both tests. *Figure 4* shows the rating of some aspects of the first (SM 2011) and the second test (SM 2012). Within the second test the rating differentiated between the Geography (Geogr) and the Geoinformatics students (Geoinf). The table shows the average rating in which 1 is the lowest and 7 the highest possible rating.

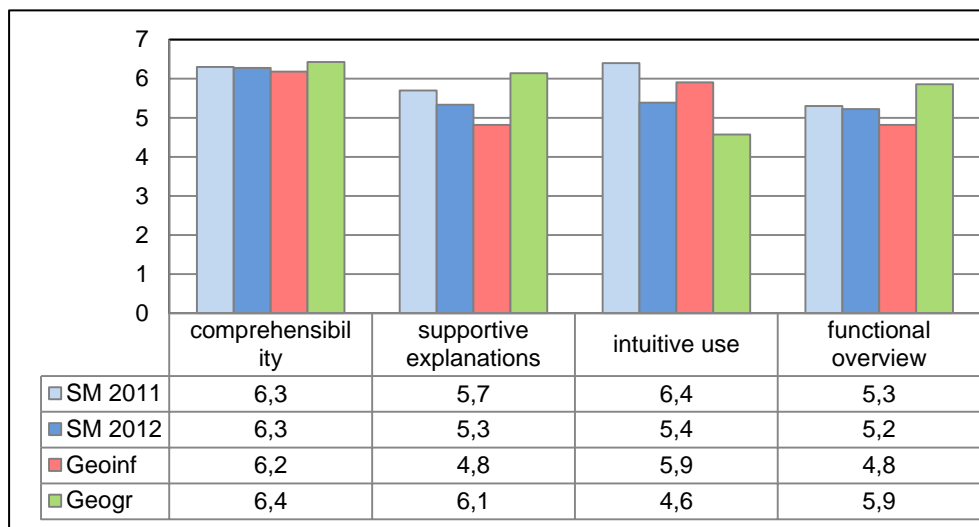


Figure 4. A selected set of measured usability aspects regarding StepMap.

Students of Geoinformatics usually have more computer and online experience and therefore are able to use the application more intuitively than the Geography students. Otherwise the Geographers rate the support possibilities of the application and the functional overviews higher than the students of Geoinformatics. This proves that StepMap is quite easy to use and is es-

pecially designed for people without any knowledge in cartography and Webmapping. More advanced people who already worked with a GIS or mapping software will probably miss some features and will try to find them for example with a help dictionary which doesn't exist on the StepMap website.

The user experience considers beside the usability further concepts like attractiveness, stimulation and identity. The focus here lies more on the subjective perception of an individual user instead of a more objective measurement of usability aspects. One approach towards describing the user experience is the model of quality perception of pragmatic and hedonic quality aspects (Hassenzahl et al. 2008). The pragmatic quality emphasises pragmatic functions and the usability of a product whereas the hedonic quality expresses what the product means and symbolises for a user. The hedonic quality addresses psychological needs of a user like curiosity and self-expression. It touches the user emotionally. Hassenzahl et al. (2008) developed the standardised questionnaire AttrakDiff2 (www.attrakdiff.de) to measure the pragmatic and hedonic quality as well as the attractiveness of an interactive product. The quality aspects are measured by means of semantic differentials. The user has to rate pairs of opposed adjectives (e.g. complicated – simple) on a seven-point rating scale.

Regarding the user experience StepMap was rated mainly as an activity-oriented application instead of a self-oriented application because the pragmatic aspects were rated a little higher than the hedonic aspects. Adjectives which were rated quite high are the following: simple, practical, manageable (pragmatic quality), innovative, creative, presentable, unprofessional (hedonic quality) and comfortable, good and inviting (attractiveness).

This proves that the application is quite simple and can be used intuitively. But StepMap is more suitable for amateurs than for experts since experts are used to more complex tools and applications and need more design possibilities and features. For example this becomes evident by the rating of the pair of adjectives professional – unprofessional at which StepMap was rated more as an unprofessional application. Furthermore the students were asked if they have additional wishes regarding the application. In this respect mainly the Geoinformatics students would like to have more special features and more explanations, e.g. a help dictionary in which they can look up certain functionalities. Some of the Geography students mentioned that they would like to have a better overview about the offered features. They like that StepMap is good to handle especially for first-time users in map-making.

5. Requirements and Design Opportunities for a Webmapping Application for Prosumers

Certain general requirements for a Webmapping application for prosumers can be derived from the prosumer survey and the usability and user experience testing. First of all the application has to be designed user-friendly and should be easy and intuitively to use. Another important aspect is that the application should be free of charge. Especially in the Internet people are used to having free access to websites and information systems. Since prosumers want to create their own individual maps based on their interests and needs they do need the possibility to change the cartographic design of the base map and to create their own map signs, for example. The application should more or less give the opportunity to create maps quite fast. Another important aspect, which arose from the prosumer survey, is a good customer service by the application owner as well as good help functions and short explanations. And finally the application should provide maps with interactive features like zooming or hyperlinks inside the map.

So what kind of design would be a good one for a Webmapping application in the Web 2.0? Regarding the heterogeneous prosumers with their different skills and knowledge and different requirements one could try to meet all these users and the different use cases. On the one hand one opportunity would be to design a Webmapping application with a lot of different features, many map design possibilities and many different possible contents and a selection of different base maps. But this kind of application tends to result in a quite complex and too extensive system, which would rather be hard to use. In consequence this leads to the risk that a lot of non-readable and non-useful or even wrong maps would be produced, although advanced prosumers with certain knowledge would rather like this kind of application, in which they have lots of freedom and possibilities in their map creation. On the other hand one could consider designing several different Webmapping applications for diverse purposes and use cases. These applications would be oriented towards special topics offering only certain functions and contents. In this case the cartographic design possibilities will be quite limited but the application would be arranged in a clear way and would be more intuitively to use. The disadvantage in this case would be that the prosumers have to use diverse applications for different purposes.

A third option would be to try to combine these first two design models and to benefit from the advantages of both of them. This would lead to a comprehensive application which also includes different specialised modules for diverse purposes and map themes. The prosumer will be guided by a dialogue-oriented step-by-step process through the application which leads him according to his use case to a certain module. This module only offers

those functions, design opportunities and methods of cartographic representation relevant for this case. Additionally it would also be possible to offer the whole application including all features and design possibilities to the user if he wants to.

Kraak's (2011) thoughts about an application to meet different user requirements go in the same direction. He calls for more research and experiments (e.g. user requirement analysis and usability testing) to realise "a step-by-step visualization strategy linked to the user task that is able to automatically adapt the cartographic design based on the visualization strategy phase, and to select/offer a suitable representation in an interactive environment." (Kraak 2011).

This kind of application featuring several modules and a user guided process can also be found in the field of universal usability in which the aim is "addressing the needs of all users" (Shneiderman & Plaisant 2010). Shneiderman (2003) approaches the problem in a similar way. He proposes a user interface with several layers. The first layer is especially for novice users and contains only a limited set of tools whereas higher layers include further features. Users "can move up to higher layers when needed or when they have time to learn further features" (Shneiderman 2003). In this case the number of features grows with every layer but without the consideration of a special use case. Therefore this approach is not so much task-oriented.

6. Conclusion

This paper presented the results of a prosumer survey and of usability and user experience tests regarding the Webmapping application StepMap. Furthermore conclusions were drawn on how a user-friendly Webmapping application should be designed.

The potential of Webmapping applications like StepMap lies in the possibility to meet the requirements and wishes of map users in a better way and to involve them in the map production so that the prosumers can produce their own individual maps regarding their needs. They are creative and sometimes produce maps in which they combine different themes or visualise contents for the first time of which nobody has thought of before. These maps produced and published by the prosumers can be used by others and offer a great variety of different maps.

To improve the support for the users the map creation with a Webmapping application has to be simple and intuitive. A dialogue-oriented step by step process can guide the prosumers through the application and helps them to

produce their needed maps so that novice users without any knowledge in map-making can create their maps, too.

This research only considers one application and their prosumers but can still already give general hints on how to improve the support for the prosumers in their map creation and how a Webmapping application for prosumers should be designed. Therefore further research has to be done with other Webmapping applications and their prosumers.

References

- Coleman DJ, Georgiadou Y, Labonte J (2009) Volunteered Geographic Information: The Nature and Motivation of Producers. *International Journal of Spatial Data Infrastructure Research* 4:332-358
- Budhathoki NR (2010) Participants' Motivations to Contribute Geographic Information in an Online Community. PhD Dissertation, University of Illinois at Urbana-Champaign
- Freitag U (2001) Die Entwicklung der Theorie der Kartographie. Koch WG (Editor) *Theorie 2000 (=Kartographische Bausteine, 19)*. Dresden, p 4-14 and 130-144
- Gartner G (2009) Web mapping 2.0. Dodge M, Kitchin R, Perkins C (Editors) *Rethinking Maps*. Routledge, London, p 68-82
- Haklay M, Singleton A, Parker C (2008) Web Mapping 2.0: The Neogeography of the GeoWeb. *Geography Compass* 2:2011-2039
- Hassenzahl M, Burmester M, Koller F (2008) Der User Experience (UX) auf der Spur: Zum Einsatz von www.attrakdiff.de. Brau H, Diefenbach S, Hassenzahl M, Koller F, Peissner M, Röse K (Editors) *Usability Professionals 2008. Proceedings of the sixth workshop of the German Chapters of the Usability Professionals Association e.V.*, p 78-82
- Hoffmann K (2011) Nutzergenerierte Karten und kartographische Kommunikation im Web 2.0. *Kartographische Nachrichten* 61:72-78
- Kolacny A (1969) Cartographic Information – a fundamental concept and term in modern cartography. *Cartographic Journal* 6:47-49
- Kraak MJ (2011) Is There a Need for Neo-Cartography? *Cartography and Geographic Information Science* 38:73-78
- Prümper J (2007): Fragebogen ISONORM 9241/110-S. <http://www.seikumu.de/de/dok/dok-echtbetrieb/Fragebogen-ISONORM-9241-110-S.pdf>. Accessed 7 April 2013
- Sarodnick F, Brau H (2011) *Methoden der Usability Evaluation. Wissenschaftliche Grundlagen und praktische Anwendung*. 2nd Edition, Verlag Hans Huber, Bern

- Shneiderman B (2003) Promoting Universal Usability with Multi-Layer Interface Design. Proceedings of the 2003 conference on Universal Usability. New York, p 1-8
- Shneiderman B, Plaisant C (2010) Designing the User Interface. Strategies for Effective Human-Computer Interaction. 5th edition, Addison Wesley, Boston
- Stark HJ (2010) Umfrage zur Motivation von Teilnehmern von OpenGeodata Projekten. Proceedings of the FOSSGIS 2010 – Conference for Free and Open Source Software for Geographical Information Systems, p 173-177